

REMARKS

Claims 1-5, 8-10 and 15 are all the claims pending in the application.

Claim 8 has been canceled without prejudice or disclaimer.

New claims 16-21 have been added to provide additional claim scope.

PRIOR ART REJECTIONS

Section 1:

The Examiner has rejected claims 1-3 under 35 U.S.C. § 102(b) as being anticipated by Miura et al. (U.S. Patent No. 6,027,669). Applicants traverse these rejections because Miura et al. fails to disclose or suggest all of the limitations of the claims as amended.

The claimed invention relates to a glass substrate for a phase shift mask blank to be exposed by an ArF excimer laser, a glass substrate for a phase shift mask blank to be exposed by an F₂ excimer laser, or a glass substrate for a EUV reflective mask blank, in which a phase defect occurs when fine protrusions are present on a principal surface of a glass substrate.

In the glass substrate for the phase shift mask blank to be exposed, a surface roughness (smoothness) is required in exposure wavelength to be used. In addition fine convex surface defects may cause a problem. Therefore, it is required that the rate of occurrence of the fine convex defects formed on the surface of the substrate be zero or very low in the polishing method.

Further, the fine convex defects can not be detected by a surface roughness measuring system such as an atomic force microscope depending upon a height or a size thereof. Consequently, the above-mentioned problem can not be found only by measuring the surface roughness.

Moreover, the defect inspection of the glass substrate was conventionally carried out by the use of visual inspection. However, as the exposure wavelength becomes shorter, an allowable defect size is also reduced. Thus, the defect inspection of the glass substrate using the exposure light source such as the ArF excimer laser, the F₂ excimer laser and the EUV has limitations with respect to the visual inspection. Under the aforementioned circumstances, the claimed invention has been completed.

Regarding Miura, it fails to disclose the specific application used in the specific wavelength according to the claimed invention, i.e. application for the glass substrate for the phase shift mask blank to be exposed by the ArF excimer laser, the glass substrate for the phase shift mask blank to be exposed by the F₂ excimer laser, and the glass substrate for the EUV reflective mask blank. Thus, the claimed invention is different from Miura in application of the substrate. Also, it is difficult to apply the photomask of Miura to the above-mentioned specific application in view of preventing reduction of the polishing rate.

Section 2:

The Examiner has rejected claims 1-3 under 35 U.S.C. § 102(b) as being anticipated by Miura et al. in view of Grant (Grant Chemical Dictionary). Applicants traverse these rejections because the cited references fails to disclose or suggest all of the limitations of the claims as amended as discussed above in section 1.

Section 3:

The Examiner has rejected claim 2 under 35 U.S.C. § 102(b) as being anticipated by Jacquiniot et al. (U.S. Patent No. 6,126,518). Applicants traverse these rejections because Jacquiniot fails to disclose or suggest all of the limitations of the claims as amended.

Regarding Jacquiniot, it discloses the semiconductor substrate as application. By contrast, according to the claimed invention, as application, use is made of the glass substrate for the phase shift mask blank to be exposed by the ArF excimer laser, the glass substrate for the phase shift mask blank to be exposed by the F₂ excimer laser, and the glass substrate for the EUV reflective mask blank. Jacquiniot fails to disclose the specific application used in the specific wavelength according to the present invention. Thus, the present claimed invention is different from Jacquiniot in application of the substrate. Further, it is difficult to apply the semiconductor substrate of Jacquiniot to the above-mentioned specific application in view of achieving a high level flatness.

Section 4:

The Examiner has rejected claims 1-3 under 35 U.S.C. § 103(a) as being unpatentable over Jacquiniot in view of Miura. Applicants traverse these rejections because the cited

references fails to disclose or suggest all of the limitations of the claims as amended as discussed above in sections 1 and 3.

Section 5:

The Examiner has rejected claims 1-3 and 8-10/1-3 under 35 U.S.C. § 103(a) as being unpatentable over Berkey et al. (U.S. Patent No. 6,265,115) in view of Okamoto et al. (U.S. Patent No. 6,020,109) or Shoki et al. (U.S. Pub. No. 2002/0110743), and further in view of Jacquinet and Miura. Applicants traverse these rejections because the cited references fail to disclose or suggest all of the limitations of the claims as amended.

Regarding Berkey, it discloses polishing the photomask blank-glass substrate for F₂ excimer lasers by the use of the colloidal silica abrasive grains in order to finish to the surface roughness of 0.15 nm in Rq. However, Berkey fails to disclose the polishing method of the present invention. Also, Berkey fails to address the problem with respect to the phase defects due to the fine convex surface defects on the surface of the glass substrate. Moreover, since Berkey discloses only the surface roughness, the surface of the glass substrate may have the fine convex surface defects thereon.

Regarding Okamoto, it merely discloses the phase shift mask. However, Okamoto fails to address the problem with respect to the phase defects due to the fine convex surface defects on the surface of the glass substrate. Further, Okamoto discloses only the step of polishing and cleaning before the Cr-sputtering step with respect to the polishing method of the glass substrate. Thus, Okamoto fails to disclose the polishing method of the present invention.

Regarding Shoki, it discloses only the EUV mask blank, the glass substrate and the surface roughness thereof. Further, Shoki discloses only the mechanical polishing as the specific polishing method. Thus, Shoki fails to disclose the polishing method of the present invention.

Regarding Jacquinet and Miura, please see sections 1 and 3 above.

Section 6:

The Examiner has rejected claims 4, 5 and 15 under 35 U.S.C. § 103(a) as being unpatentable over Yoshikawa et al. (U.S. Pub. No. 2003/0228461) in view of Watanabe et al. (U.S. Patent No. 6,277,465), and further in view of Maekawa et al. (U.S. Patent No. 5,868,953).

Applicants traverse these rejections because the cited references fail to disclose or suggest all of the limitations of the claims as amended.

Regarding Yosikawa, it discloses polishing the glass substrate for the information recording medium as application. By contrast, according to the claimed invention, as application, use is made of the glass substrate for the phase shift mask blank to be exposed by the ArF excimer laser, the glass substrate for the phase shift mask blank to be exposed by the F₂ excimer laser, and the glass substrate for the EUV reflective mask blank. Yosikawa fails to disclose the specific application used in the specific wavelength according to the present invention. Thus, the claimed invention is different from Yosikawa in application of the substrate. Further, it is difficult to apply the glass substrate for the information recording medium of Yosikawa to the above-mentioned specific application in view of increasing productivity and flatness.

Regarding Maekawa and Watanabe, they disclose the glass substrate for magnetic disk as application. By contrast, according to the claimed invention, as application, use is made of the glass substrate for the phase shift mask blank to be exposed by the ArF excimer laser, the glass substrate for the phase shift mask blank to be exposed by the F₂ excimer laser, and the glass substrate for the EUV reflective mask blank. Maekawa and Watanabe fail to disclose the specific application used in the specific wavelength according to the present invention. Thus, the claimed invention is different from Maekawa and Watanabe in application of the substrate.

Also, the claimed invention is characterized in the surface roughness control step using the polishing liquid comprising colloidal silica abrasive grains in the polishing process and the protrusion suppressing step of using the polishing liquid comprising colloidal silica abrasive grains, controlling to a pressure lower than the predetermined pressure and suppressing occurrence of a fine convex protrusion. By contrast, Maekawa and Watanabe disclose using cerium oxide. However, Maekawa and Watanabe fail to disclose the above-mentioned surface roughness control step using the polishing liquid comprising colloidal silica abrasive grains in the polishing process and the protrusion suppressing step of changing the pressure.

Section 7:

The Examiner has rejected claims 4, 5, 8-10/4-5 and 15 under 35 U.S.C. § 103(a) as being unpatentable over Yoshikawa et al. in view of Watanabe et al. and Maekawa et al., and further in view of Berkey and either Okamoto or Shoki. Applicants traverse these rejections because the cited references fail to disclose or suggest all of the limitations of the claims as amended. Please refer to sections 5 and 6 above.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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